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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/820,822	04/09/2004	Hae-Kyoung Kim	61610134US	8493

58027 7590 05/25/2007

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EXAMINER	
WANG, EUGENIA	

ART UNIT	PAPER NUMBER
1745	

MAIL DATE	DELIVERY MODE
05/25/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/820,822	KIM ET AL.	
	Examiner	Art Unit	
	Eugenia Wang	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 09 April 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. In response to the amendment received March 15, 2007:

a. Claims 1-20 are pending.

b. The previous objection to the drawing is withdrawn in light of the amendment to the specification.

c. The previous objection to the specification in withdrawn in light of the amendment.

d. The previous 112 rejection is maintained.

e. The previous prior art rejection, with respect to claims 1-16, has been withdrawn, and a new grounds of rejection has been made herein, necessitated by the amendment. The previous art rejection, with respect to claims 17-20, is maintained. Thus this office action is final.

Drawings

2. The drawings submitted April 9, 2004 are accepted.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 2, 5, 8, 13, 14 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The applicant has not provide any guidance as to how the sensor detects the fuel concentration using characteristic that volumes of the sensor change depending on the fuel concentration. What is the relationship between the sensor volume change and the fuel concentration?

In MPEP 2164 and 2164.01 states "...when claimed subject matter is only presented in the claims and not in the specification portion of the application, the specification should be objected to for lacking the requisite support for the claimed subject matter... it has been interpreted to require that the claimed invention be enabled so that any person skilled in the art can make and use the invention without undue experimentation. In re Wands, 858 F.2d at 737, 8 USPQ2d at 1404 (Fed. Cir. 1988)."

Factors to be considered in determining whether the claimed invention would require undue experimentation are given in MPEP 2164.01(a). In re Wands, 858 F. 2d 731, 737; 8 USPQ 2d 1400, 1404 (Fed. Cir. 1988). Only the relevant factors will be addressed herein for determining undue experimentation of the presently claimed invention. The relevant factors are (A) Breadth of the claims; (B) The nature of the invention; (C) The state of the prior art; and (D) The amount of direction provided by the inventor.

Factor (A) Breadth of the claims:

No guidance is given in the specification for relating the volume change of the sensor to the concentration of fuel, which the sensor is in contact with. It is unclear how the volume change of the sensor substrate conveys the concentration of the fuel. The relationship between an electronic signal output and the change in volume of the sensor resulting from measuring the fuel concentration is not disclosed

Factor (B) The nature of the invention:

By what means can a volume change of the sensor film located on the substrate layer of the sensor correlate to the concentration of the fuel within an electrochemical device? The applicant has not provided enough information so that one having ordinary skill in the art might make and use the invention of a sensor that changes in volume to indicate the concentration of the fuel with which it is in contact. In paragraph 29 on page 8 of the specification the applicant states with respect to Figure 3, a sensor comprising a pressure film on a substrate varies in volume depending on the concentration of the fuel. There is no disclosure of how to use the sensor for determining the concentration or change in concentration of a given fuel solution.

Factor (C) The state of the prior art:

In the prior art it is known that passing an electrical current through a conductor and measuring the change in electrical resistance of the conductor is an accurate method of measuring a change in concentration of the conductor. Therefore, as the fuel concentration changes, the electrical resistance of the conductor in contact with the fuel changes. In an electrochemical device, a current sensor is used to measure the current in a short circuit across the sensor electrodes. The measured current across the sensor

electrodes is then correlated to the concentration of the substance with which the sensor has contact. The current application is not aligned with the known method of determining the concentration of a substance.

Factor (D) The amount of direction provided by the inventor:

The applicant's claim of a measuring a fuel concentration with a sensor that undergoes a volume change provides no insight as to how to make and use the claimed invention. The change in volume of a material or solution is not an indication of its concentration as shown in the prior art. The applicant does not provide the proper mechanism by which a volume change in a material relates to the concentration of the material.

Having considered the evidence as a whole, the claims are properly rejected for scope of enablement as set for in MPEP section 2164.04 and 2164.05.

5. Claims 5 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear what the applicant means by detecting the fuel concentration using characteristics that volumes of the sensor change depending on the fuel concentration.

Response to Arguments

6. Applicant's arguments filed March 15, 2007 have been fully considered but they are not persuasive.

As to the 112, first paragraph rejection to claims 2, 5, 8, 13, and 14, Applicant argues sufficient enablement exists because: (a) para 0023-0025 and 0028 describe the

location and function of the sensor, (b) para 0029-0036-0037 and figs. 3-4 show the structure and operation, (c) the material of the pressure film is disclosed in para 0030 and 0036, and (d) that para 0032 and 0039 along with figs. 5-6 show the substantially linear relationship between the volume change of the sensor and the concentration of fuel within a certain concentration range.

Examiner respectfully disagrees. While the indicated portions in the argument broadly presents the relationship, it lacks reasonable description as to how pressure and volume is correlated to the concentration.

As to the 112, second paragraph rejection to claims 5 and 8, applicant argues that paragraph 0024 indicates the volume of the sensor depends on the concentration of the fuel and that the sensor detects the fuel concentration according to the change in its volume.

Examiner respectfully disagrees. While the indicated paragraph broadly presents the relationship, it lacks reasonable description as to how the fuel concentration is detected using the volume an dhow the sensor changes in accordance to that.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Surampudi et al. (US 6,303,244 B1).

Surampudi et al. (herein after Surampudi '244) discloses a direct methanol feed fuel cell system. The system is composed of a fuel cell stack, a methanol fuel storage tank, a circulating tank, condensers [940, 942] (which acts as a dilutent storage unit that stores only a dilutent that is a byproduct of the chemical reaction in the fuel cell stack), and a methanol concentration sensor that provides input to a controller to regulate the fuel cell system (col. 18 lines 5-19; See Figure 9). The fuel cell stack is comprised of an anode and cathode and generates electrical energy (col. 3 lines 25-32).

Response to Arguments

8. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi '244 as applied to claim 1 above, and further in view of Beckmann et al. (US 6,890,674 B2).

Surampudi '244 discloses all the limitations of claim 1 from which claim 2 depends. Surampudi '244 does not disclose that the sensor has a portion that varies in volume depending on the concentration of the fuel. Beckmann et al. (herein after Beckmann '674) teaches a method and apparatus for managing fluids in a fuel cell

system. Beckmann teaches the use of various devices to control fuel concentration in a direct oxidation fuel cell system such as a direct methanol fuel cell (col. 1 lines 39-42; col. 2 line 63 to col. 3 line 4). One device for determining the concentration of the fuel is a sensor (col. 3 lines 50-62). The sensor is constructed of Nafion™. The Nafion™ expands or varies in volume when exposed to a methanol solution (col. 8 lines 8-16). The amount of expansion experienced by the Nafion™ is directly related to the concentration of methanol fuel. The amount Nafion™ expands is predictable and essentially linear over the relevant methanol concentrations (col. 8 lines 21-25).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the methanol concentration sensor of Surampudi '244 to include Nafion™ (a material that varies in volume depending on the concentration of the methanol solution to which it is exposed) such as taught by Beckmann '674 in order to accurately measure and control the methanol concentration provided to the fuel cell.

10. Claims 3 and 4 rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi '244 as applied to claim 1 above, and further in view of Gottesfeld (US 6,686,081 B2). Surampudi '244 discloses all the limitations of claim 1 from which claim 3 depends. Surampudi '244 does not disclose that the fuel cell system is comprised of a fuel mixing unit where fresh fuel and a diluent (water) are mixed. Gottesfeld teaches a mixing chamber or unit that receives fresh fuel from the fuel tank and recycled water from the fuel cell stack (col. 6 lines 61-66; See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the methanol fuel cell system of Surampudi '244 to include a mixing unit such as taught by

Gottesfeld in order to thoroughly mix the fresh fuel and the diluent from the fuel cell before introducing the two process flows to the fuel cell in order to maximize the electrochemical reaction within the fuel cell.

With respect to claim 4, Surampudi '244 teaches that the methanol sensor should be located in the methanol fuel or very close to the methanol fuel (col. 18 lines 14-15).

11. Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi '244 in view of Gottesfeld (US 6,686,081 B2) as applied to claims 1, 3, and 4 above, and further in view of Beckmann et al. (US 6,890,674 B2). Surampudi '244 in view of Gottesfeld discloses all the limitations of claims 1, 3, and 4 on which claim 5 is dependent. Surampudi '244 in view of Gottesfeld does not disclose that the sensor detects fuel concentration using characteristics that the volume of the sensor changes depending on the fuel concentration.

Beckmann '674 teaches a method and apparatus for managing fluids in a fuel cell system. Beckmann teaches the use of various devices to control fuel concentration in a direct oxidation fuel cell system such as a direct methanol fuel cell (col. 1 lines 39-42; col. 2 line 63 to col. 3 line 4). One device for determining the concentration of the fuel is a sensor (col. 3 lines 50-62). The sensor is constructed of Nafion™. The Nafion™ expands or varies in volume when exposed to a methanol solution (col. 8 lines 8-16). The amount of expansion experienced by the Nafion™ is directly related to the concentration of methanol fuel. As the Nafion™ conductor expands, the contact between the conductive particles of the Nafion™ conductor is diminished and thus resistance of the conductor increases (col. 8 lines 52-60). The change in resistance of

the Nafion™ conductor is compared with known values associated with particular methanol concentrations (col. 8 lines 65-67). The amount Nafion™ expands is predictable and essentially linear over the relevant methanol concentrations (col. 8 lines 21-25).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the fuel cell system of Surampudi '244 in view of Gottesfeld to include a methanol concentration sensor constructed using Nafion™ (a material that varies in volume depending on the concentration of the methanol solution to which it is exposed) such as taught by Beckmann '674 in order to accurately measure and control the methanol concentration provided to the fuel cell.

With respect to Claims 6 and 7, Gottesfeld teaches in-line mixing of the diluent (water) exiting the diluent storage unit and the fresh fuel exiting the methanol fuel tank (See Figure 3 of Gottesfeld). Surampudi '244 teaches that the methanol sensor should be located in the methanol fuel or very close to the methanol fuel (col. 18 lines 14-15). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify methanol fuel cell system of Surampudi '244 to mix the fresh fuel and diluent in-line as taught by Gottesfeld and to monitor the in-line mixture (by placing the sensor in the process line) to ensure the proper fuel concentration is introduced to the fuel cell while simplifying the overall fuel cell system.

With respect to Claim 8, Beckmann teaches the use of a fuel concentration sensor (col. 3 lines 50-62). The sensor is constructed of Nafion™. The Nafion™ expands or varies in volume when exposed to a methanol solution (col. 8 lines 8-16).

The amount of expansion experienced by the Nafion™ is directly related to the concentration of methanol fuel. The amount Nafion™ expands is predictable and essentially linear over the relevant methanol concentrations (col. 8 lines 21-25). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the fuel cell system of Surampudi '244 in view of Gottesfeld to include a methanol concentration sensor constructed using Nafion™ (a material that varies in volume depending on the concentration of the methanol solution to which it is exposed) such as taught by Beckmann '674 in order to accurately measure and control the methanol concentration provided to the fuel cell.

12. Claims 9-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi et al. (US 6,303,244 B1) as applied to claim 1 above and in view of Narayanan et al. (US 6,306,285 B1), Beckmann et al. (US 6,890,674 B2), and Homma et al. (US 5,033,293). Surampudi et al. (herein after Surampudi '244) discloses a direct methanol feed fuel cell system comprised of a methanol concentration sensor. Surampudi '244 does not disclose that the methanol concentration sensor is comprised of a substrate and a sensor film attached to the substrate and that the sensor changes volume depending on the concentration of the methanol. Also, Surampudi '244 does not disclose that the sensor is manufactured using a polymeric ion exchange resin such a perfluorinated sulfonic acid polymer having an internal and external electrode.

Narayanan et al. (herein after Narayanan '285) teaches techniques for sensing methanol concentration in aqueous environments. A methanol concentration sensor for use in a liquid direct-feed fuel cell is discussed. The sensor comprises a Nafion™ sensor

film (a perfluorinated sulfonic acid polymer also known as a polymeric ion exchange resin) deposited on the surface of a porous electrode backing substrate such as porous carbon paper (col. 4 lines 29-41). The membrane electrode assembly formed by the sensor film and the porous electrode backing substrate is sandwiched between a cathode and anode current collector and placed in contact with the methanol fuel solution (col. 4 lines 48-50).

Beckmann et al. (Beckmann '674) teaches method and apparatus for managing fluids in a fuel cell system, particularly devices to control fuel concentration in a direct oxidation fuel cell system such as a direct methanol fuel cell (col. 1 lines 39-42; col. 2 line 63 to col. 3 line 4). One device for determining the concentration of the fuel is a sensor (col. 3 lines 50-62). The sensor is constructed of Nafion™. The Nafion™ expands or varies in volume when exposed to a methanol solution (col. 8 lines 8-16). As the Nafion™ conductor expands, the contact between the conductive particles of the Nafion™ conductor is diminished and thus resistance of the conductor increases (col. 8 lines 52-60). The change in resistance of the Nafion™ conductor is compared with known values associated with particular methanol concentrations.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the methanol concentration sensor of Surampudi '244 to include a polymeric ion exchange resin such as a perfluorinated sulfonic acid polymer sensor film on a substrate such as taught by Narayanan '285 in order to detect the current change (resistance) in the fuel solution and therefore the concentration of the fuel solution.

With respect to claim 10 and Narayanan '285 teaches the connection of the methanol concentration sensor to a sensor response circuit. The membrane electrode assembly formed by the sensor film and the porous anode and cathode electrode backing substrate is sandwiched between a cathode and anode current collector (col. 4 lines 48-50). Narayanan '285 does not explicitly teach that the membrane electrode assembly of the sensor is comprised of an external electrode and an internal electrode. Honma et al. (herein after Honma '293) teaches an alcohol concentration sensor having an internal and external electrode (See Figure 3; col. 3 lines 25-30). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the methanol concentration sensor of Surampudi '244 in view of Narayanan '285, Beckmann '674, and Honma '293 to include an external electrode and an internal electrode in the concentration sensor for contacting the electrode with the methanol for concentration detection. The courts have held that rearranging parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70.

With respect to claims 13 and 14 Narayanan '285 teaches the connection of the methanol concentration sensor to a sensor response circuit to detect a concentration-dependent response from the sensor element. The flow of current through the sensor element causes the electrochemical reaction to take place. The current is measured by an ammeter (col. 3 lines 17-20). The change in volume of the Nafion™ in the concentration sensor corresponds to the amount of current flow (or resistance to current flow) as taught by Beckmann '674. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the

methanol concentration sensor of Surampudi '244 in view of Narayanan '285 and Beckmann '674 to include an electric circuit that outputs an electrical signal depending on the sensor volume change such as taught by Narayanan '285 and Beckmann '674 in order to accurately relate the fuel concentration to a measurable electrical output of the cell.

13. Claims 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Narayanan et al. (US 6,306,285 B1) in view of Beckmann et al. (US 6,890,674 B2) and Goto et al. (US 2001/0037000 A1). Narayanan et al. (herein after Narayanan '285) teaches techniques for sensing methanol concentration in aqueous environments. A methanol concentration sensor for use in a liquid direct-feed fuel cell is discussed. The sensor comprises a Nafion™ sensor film (a perfluorinated sulfonic acid polymer also known as a polymeric ion exchange resin) deposited on the surface of a porous electrode backing substrate such as porous carbon paper (col. 4 lines 29-41). The membrane electrode assembly formed by the sensor film and the porous electrode backing substrate is sandwiched between a cathode and anode current collector and placed in contact with the methanol fuel solution (col. 4 lines 48-50). Narayanan '285 does not explicitly teach that the Nafion™ changes in volume to indicated the concentration of the fluid with which it has contact.

Beckmann et al. (Beckmann '674) teaches method and apparatus for managing fluids in a fuel cell system, particularly devices to control fuel concentration in a direct oxidation fuel cell system such as a direct methanol fuel cell (col. 1 lines 39-42; col. 2 line 63 to col. 3 line 4). One device for determining the concentration of the fuel is a

sensor (col. 3 lines 50-62). The sensor is constructed of Nafion™. The Nafion™ expands or varies in volume when exposed to a methanol solution (col. 8 lines 8-16). As the Nafion™ conductor expands, the contact between the conductive particles of the Nafion™ conductor is diminished and thus resistance of the conductor increases (col. 8 lines 52-60). The change in resistance of the Nafion™ conductor is compared with known values associated with particular methanol concentrations.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to include the methanol concentration sensor having a polymeric ion exchange resin such as a perfluorinated sulfonic acid polymer sensor film on a substrate such as taught by Narayanan '285 in order to detect the current change (resistance) in the fuel solution as indicated by the change in volume of the sensor as taught by Beckmann '674.

With respect to claim 19, Neither Narayanan '285 nor Beckmann '674 teach the use of polystyrene sulfonic acid, poly ether ether sulfone sulfonic aced, sulfonated polyolefin, or sulfonated polysulfone as the polymeric ion exchange membrane in the sensor. Goto et al. (herein after Goto '000) teaches the use of a sulfonated polyolefin such as polyarylene copolymer as conductive proton membranes in batteries, fuel cells, and sensors (Paragraph 146). The sulfonated polyarylene copolymer is not brittle and adheres well to substrates. The proton conductivity of the sulfonated polyarylene copolymer is stable over a wide ranger of temperatures. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the methanol sensor of Narayanan '285 to include a polymeric ion exchange membrane or

resin such as taught by Goto '000 because it adheres well to substrates and due to its ability to conduct protons over a wide temperature range.

14. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Narayanan et al. (US 6,306,285 B1) in view of Beckmann et al. (US 6,890,674 B2). Narayanan et al. (herein after Narayanan '285) teaches techniques for sensing methanol concentration in aqueous environments. A methanol concentration sensor for use in a liquid direct-feed fuel cell is discussed. The sensor comprises a Nafion™ sensor film (a perfluorinated sulfonic acid polymer also known as a polymeric ion exchange resin) deposited on the surface of a porous electrode backing substrate such as porous carbon paper (col. 4 lines 29-41). The membrane electrode assembly formed by the sensor film located between the porous electrode backing substrates is sandwiched between a cathode and anode current collector and placed in contact with the methanol fuel solution (col. 4 lines 48-50).

Narayanan '285 does not explicitly teach that the membrane electrode assembly of the sensor is comprised of an external electrode and an internal electrode or that the sensor member that fills the space between the electrodes changes volume depending on fuel concentration.

Beckmann et al. (Beckmann '674) teaches method and apparatus for managing fluids in a fuel cell system, particularly devices to control fuel concentration in a direct oxidation fuel cell system such as a direct methanol fuel cell (col. 1 lines 39-42; col. 2 line 63 to col. 3 line 4). One device for determining the concentration of the fuel is a sensor (col. 3 lines 50-62). The sensor is constructed of Nafion™. The Nafion™

expands or varies in volume when exposed to a methanol solution (col. 8 lines 8-16). As the Nafion™ conductor expands, the contact between the conductive particles of the Nafion™ conductor is diminished and thus resistance of the conductor increases (col. 8 lines 52-60). The change in resistance of the Nafion™ conductor is compared with known values associated with particular methanol concentrations.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the methanol concentration sensor of Narayanan '285 in view of Beckmann '674 to include a fuel concentration-dependent volume changing member between the external electrode and an internal electrode in the concentration sensor. The courts have held that rearranging parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70.

Response to Arguments

15. Applicant's arguments filed March 15, 2007 have been fully considered but they are not persuasive.

Applicant argues that with respect to claim 17 and 20, there is no motivation to combine the teachings of Narayanan '285 and Beckmann '674, because Beckmann '674's teaching has NAFION™ drawn to a the use in a concentration sensor, while Narayanan '285 uses NAFTION™ as the solid electrolyte membrane.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the

references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the combination is obvious, because electrolyte membrane [250] of Narayanan '285's teaching is part of sensor element [200]. Therefore, the sensor element disclosed by Beckmann '674 is combinable with that of Narayanan '285. Furthermore, since the material used in Beckmann '674 and the sensor element of Narayanan '285 is the same, there would be a high likelihood that they would function in the same way.

Conclusion

16. US 2002/0119353 (Edlund et al.) is made of record but not relied upon. The purpose of this piece is to show that, if the condensers of Surampudi '244 are interpreted as not to be a storage unit, that the water reservoir unit [16] of Elund et la., which holds water from the cathode exhaust, would be an obvious addition to Surampudi et al.

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugenia Wang whose telephone number is 571-272-4942. The examiner can normally be reached on 8 - 4:30 Mon. - Fri., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GREGG CANTELMO
PRIMARY EXAMINER

/EW/

23 MAY 2007